Missile Defense Briefing For
Science And Engineering Technology Conference
Sponsored By National Defense Industrial Association
North Charleston, South Carolina

5-7 FEB 02

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BALLISTIC MISSILE DEFENSE MISSION AND TECHNICAL CHANGES 1984-2001

	Research	Phase I	GAPLS	TMD	NMD	BMDS
Time Frame	• 1984-1986	• 1987-1990	• 1991-1992	• 1993-2000	• 1998-2000	• 2001-
Mission	• Protect Against Massive Soviet Attack	• Deterrence	• Protect Against Limited Attack	• Tactical Requirements	• Protect Against Limited Attack	• Defense Against All Ranges Of Ballistic Missile Threats
Element Focus	• Directed Energy Weapons (DEW)	• Space Based Interceptors (SBI) • EXO-ATM Interceptor (ERIS)	• Brilliant Pebbles • Ground Based Interceptor (GBI)	• Terminal Interceptors (THAAD)	• Exoatmospheric Kill Vehicle (EKV)	• Layered (Boost, Midcourse, Terminal)
Key Challenges	• Feasibility	• Survivability Of Space Assets	• Midcourse Discrimination	• Family Of Systems Integration	• Midcourse Discrimination (One Tier Architecture)	• T&E • BMDS Systems Integration

BMDS CHALLENGES

- **Reliable Hit-To-Kill Missiles And Robust Testing**
- **Midcourse Discrimination (Algorithms, Advanced Sensors, New Concepts)**
- **Space Sensors (Global Missile Tracking)**
- **Boost Phase Engagement (Directed Energy And Kinetic Energy)**
- **System Integration And BM/C^3**

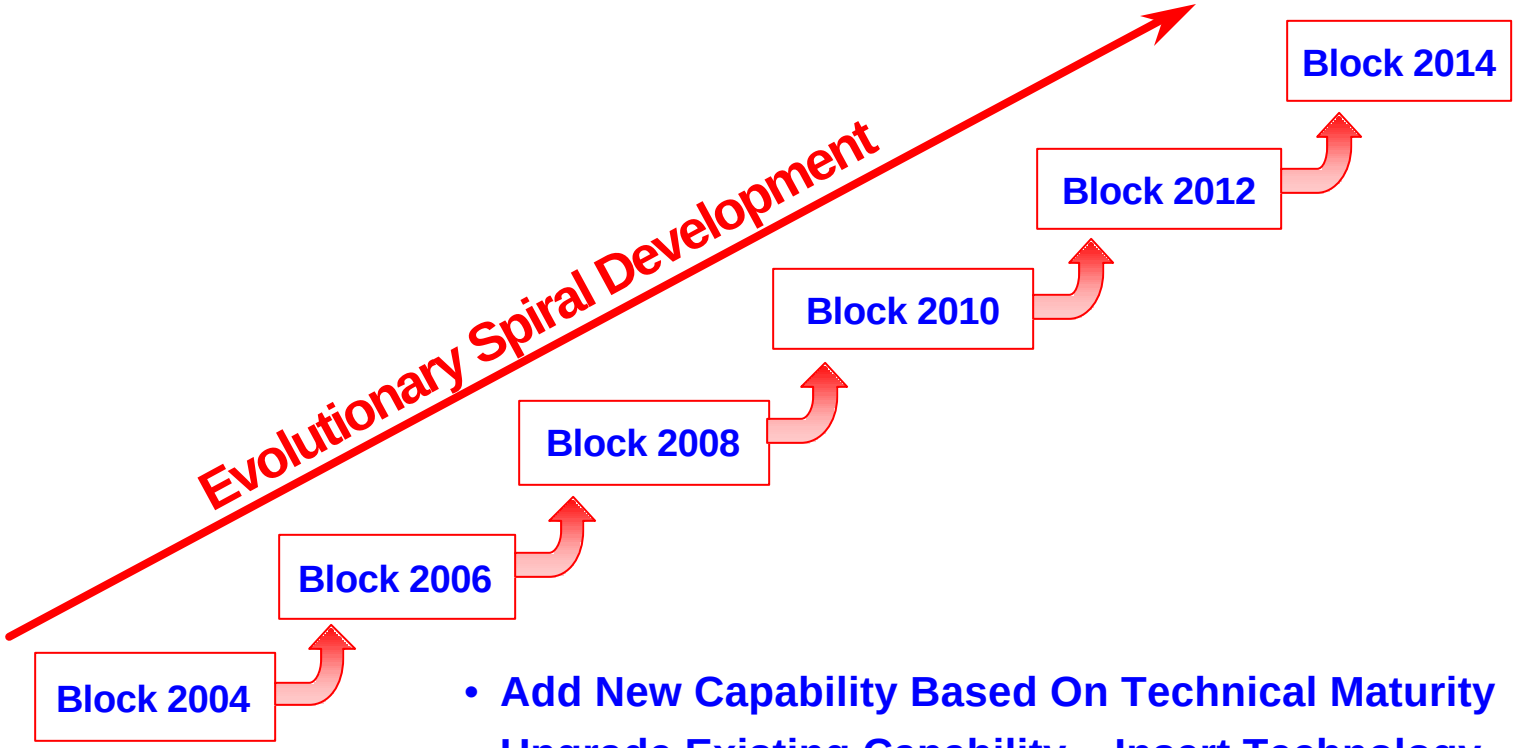
MISSILE DEFENSE PRIORITIES

- To Defend The United States, Deployed Forces, Allies, And Friends From Ballistic Missile Attack
- To Employ A Ballistic Missile Defense System (BMDS) That Layers Defenses To Intercept Missiles In All Phases Of Their Flight (i.e., Boost, Midcourse, And Terminal) Against All Ranges Of Threats
- To Enable The Services To Field Elements Of The Overall BMDS As Soon As Practicable
- To Develop And Test Technologies, Use Prototype And Test Assets To Provide Early Capability, If Necessary, And Improve The Effectiveness Of Deployed Capability By Inserting New Technologies As They Become Available Or When The Threat Warrants An Accelerated Capability

The Missile Defense Agency (MDA) Is Charged With Developing The Missile Defense System And Baselining The Capability And Configuration Of Its Elements. The Military Departments Will Procure And Provide For Missile Defense Operations And Support.

BMD EVOLUTIONARY DEVELOPMENT

CY	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015



- Add New Capability Based On Technical Maturity
- Upgrade Existing Capability – Insert Technology
- Evolve Requirements
- Procure Additional Force – Enhance Capability
- Extend To Allies And Friends When Appropriate

"DENY ASYMMETRIC ADVANTAGES TO ADVERSARIES"

Midcourse Defense

- Defends Wide Regions

Space Sensors

- Continuous, Global Coverage

Basing Modes

- Ground
- Sea
- Air
- Space

Technical Approach

- Varied
- Changing

Boost Defense

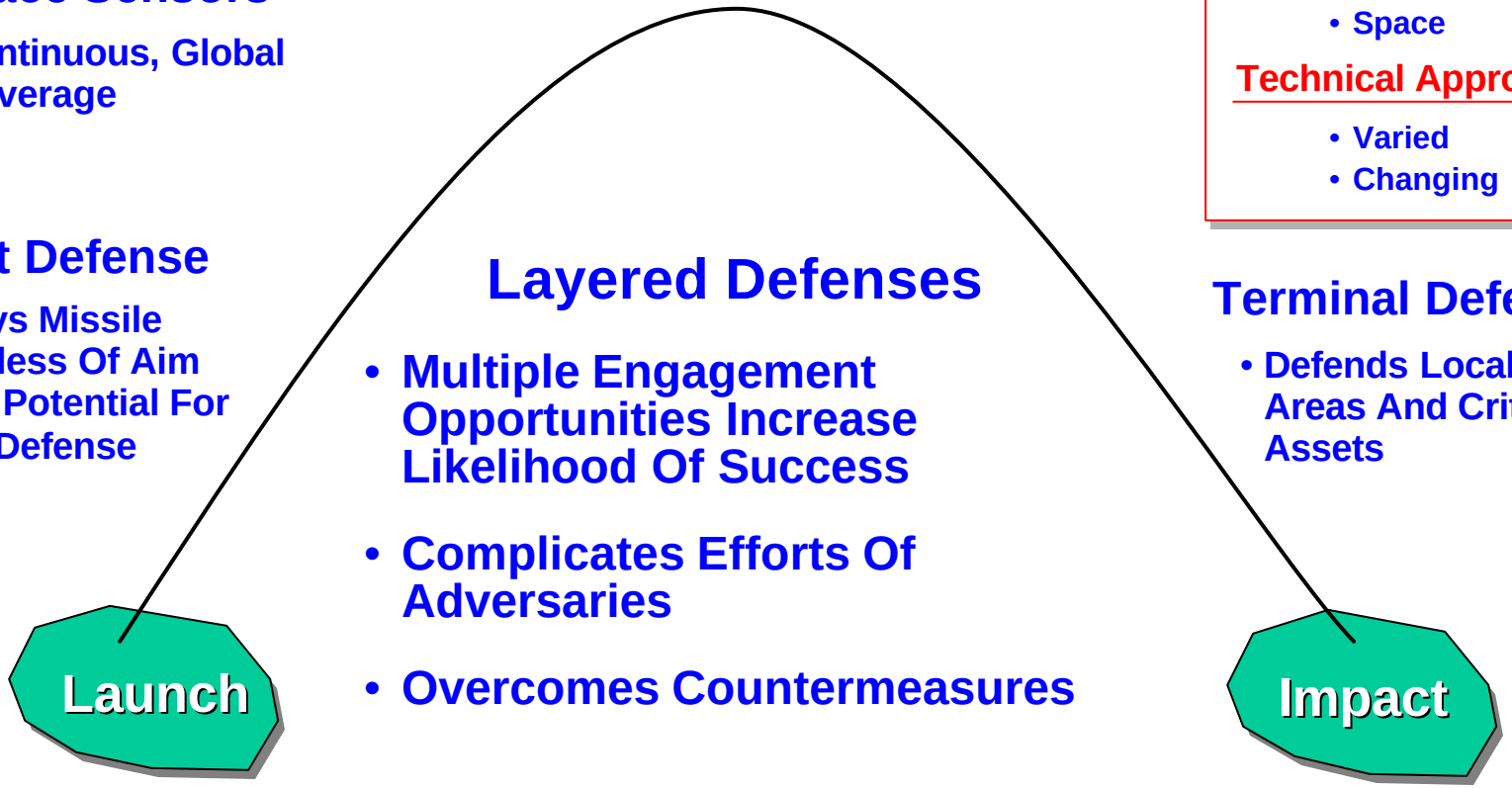
- Destroys Missile Regardless Of Aim Point – Potential For Global Defense

Layered Defenses

- Multiple Engagement Opportunities Increase Likelihood Of Success
- Complicates Efforts Of Adversaries
- Overcomes Countermeasures

Terminal Defense

- Defends Localized Areas And Critical Assets



Through Variety In The "Defensive Playbook"

TERMINAL DEFENSE SEGMENT

Midcourse Defense Segment

Terminal Defense Segment

Army

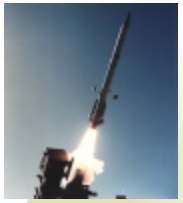
Navy

Theater Missile Defense

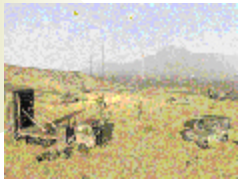
Navy Theater Wide

THAAD

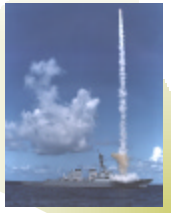
Arrow



PAC-3



MEADS



Navy Area

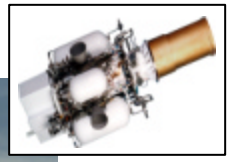
MIDCOURSE SEGMENT ELEMENTS

Ground-Based

Defense Support Program/
Space Based Infrared System
High Component

Space Based
Infrared System /
Low Component

Early Warning Radars

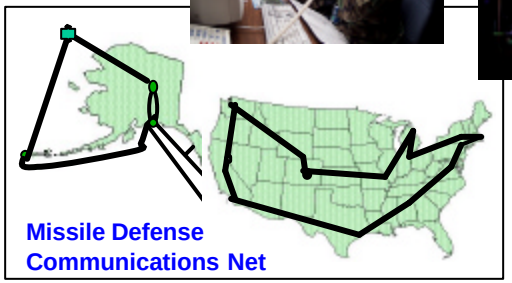


Kill Vehicle

Battle Management /
Command, Control

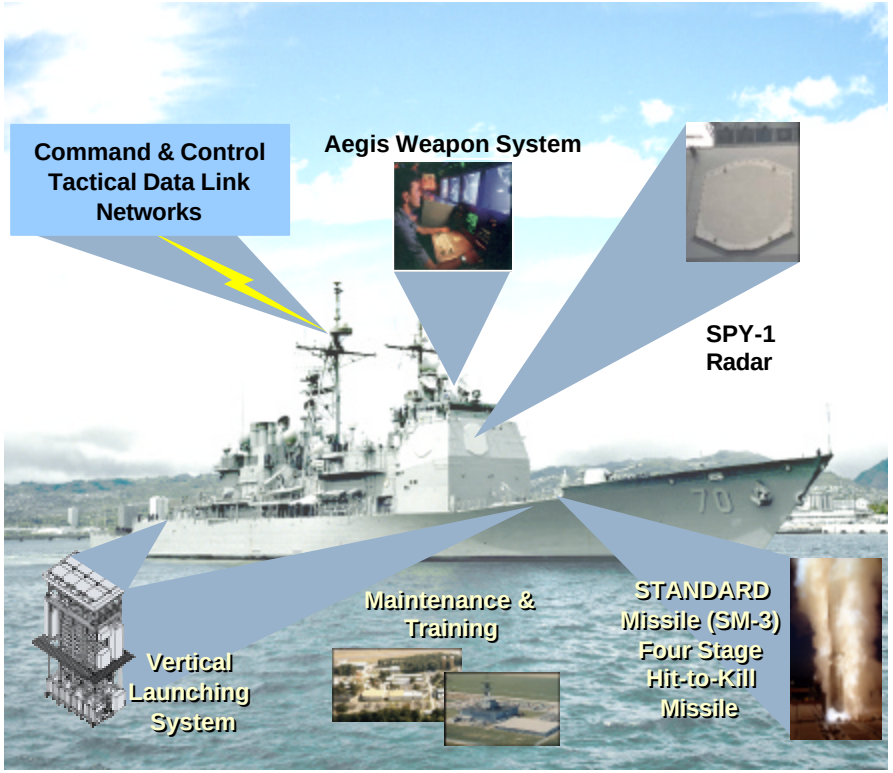
X-band Radar

Interceptor

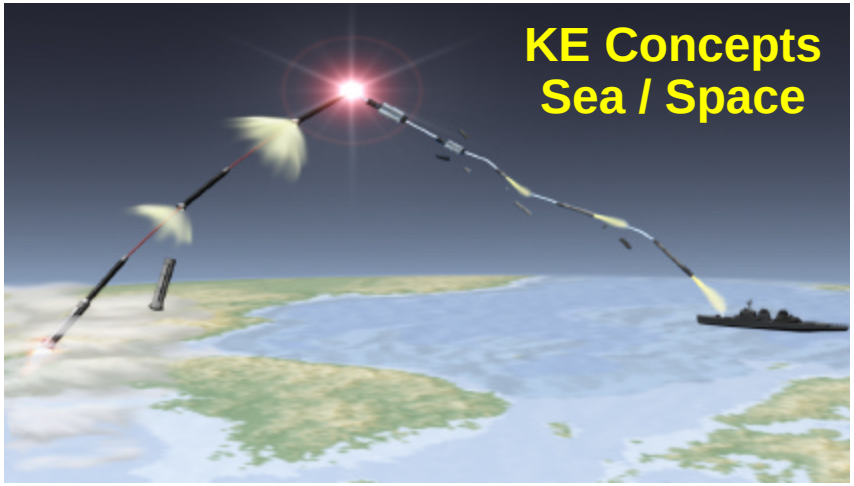


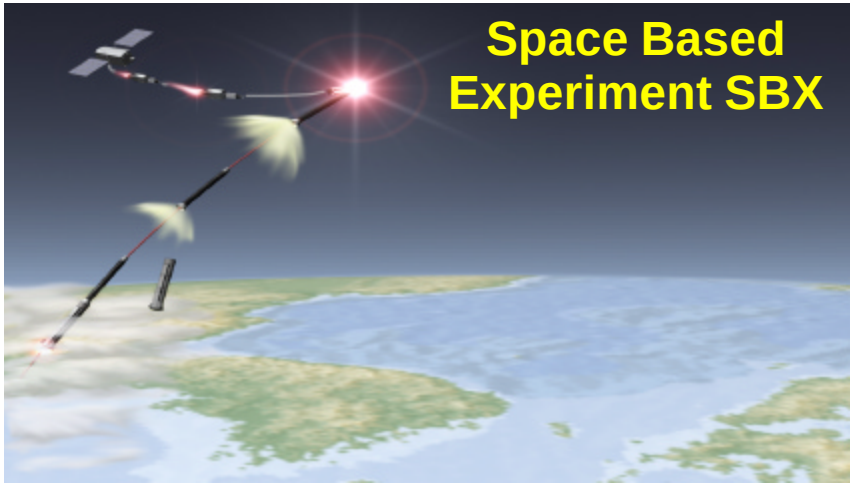
Missile Defense
Communications Net

Sea-Based

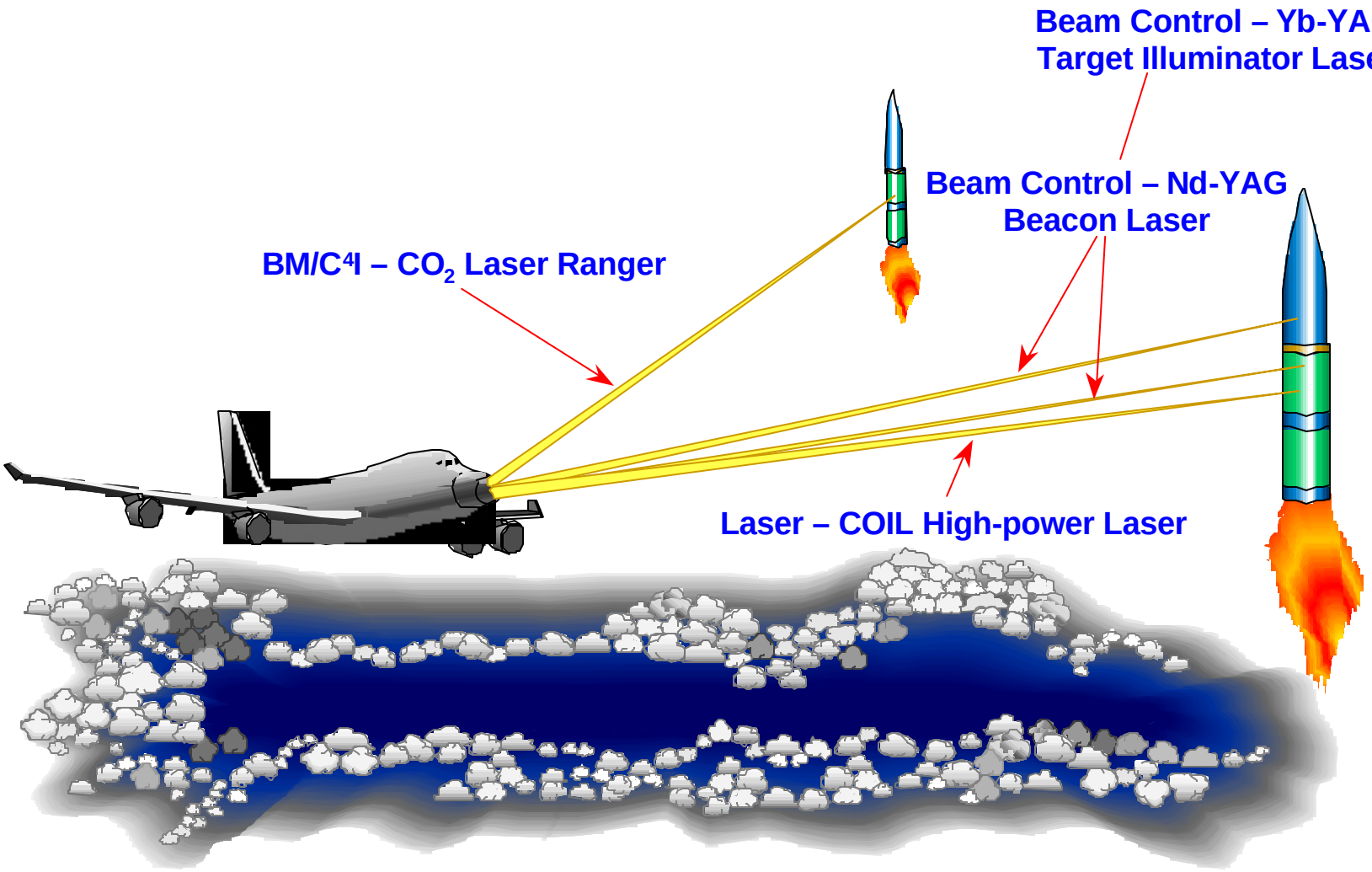


BOOST PHASE DEFENSE



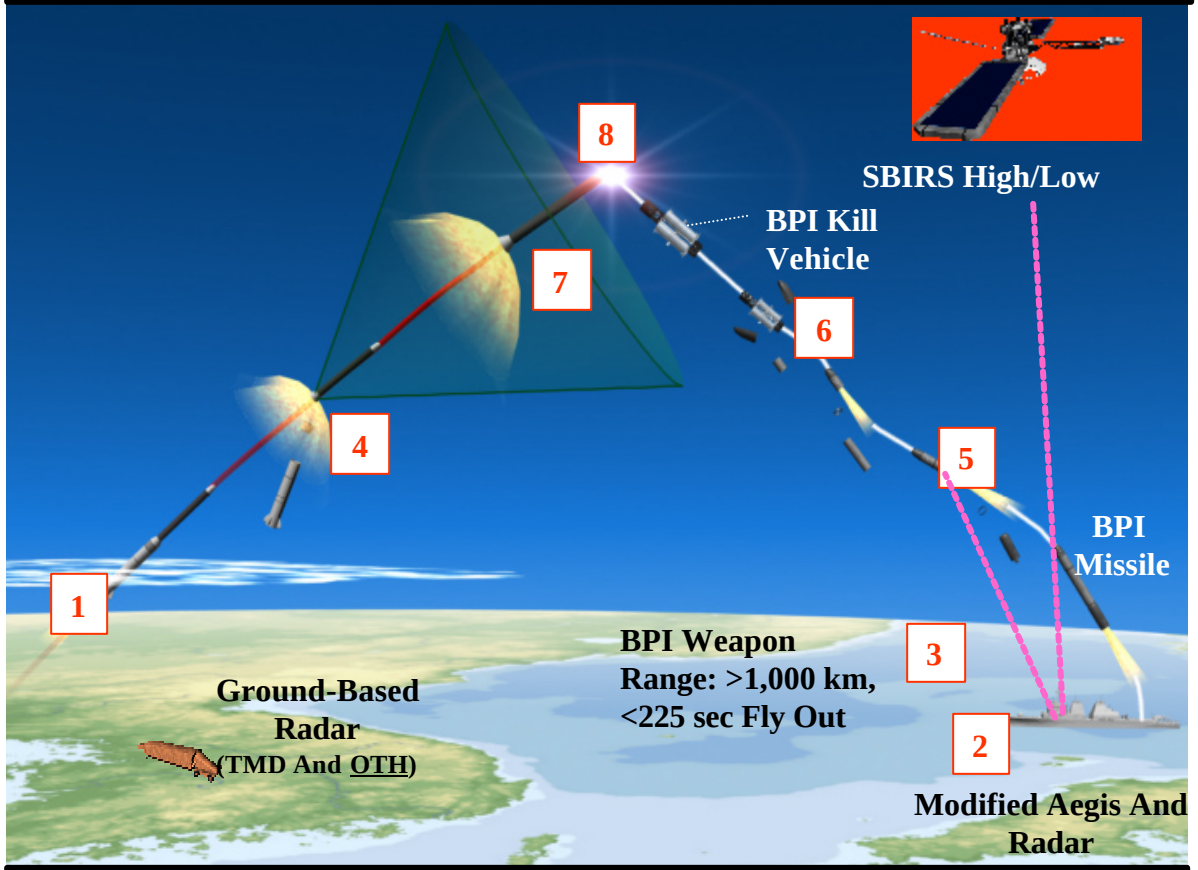


ABL HAS FOUR LASERS



KE BPI REFERENCE CONCEPT ELEMENTS AND CRITICAL ISSUES

Components –
Surveillance/BMC^2, Booster, Kill Vehicle, Platform



Sea-Based Example –
Issues Also Applicable To Land, Air and Space-Basing

Critical Issues

Decide

1. Early Launch Detection And Classification (Dual Phenomenology)
2. Quick Reaction BMC^2 And Weapon Commit

Attack

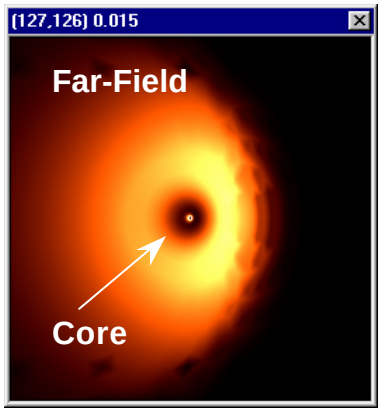
3. High Missile Acceleration And Burnout Velocity
4. Predicted Intercept Point Generation / IFTU
5. Booster Divert And Control (Guide to IFTU)
6. Flexible KV Axial-Divert Propulsion
7. Plume-to-Hardbody Handover

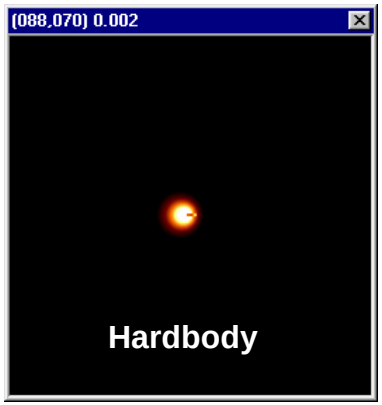
Kill

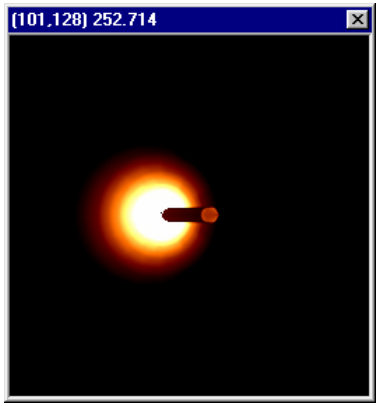
8. Aim Point Selection And Lethality

NOTIONAL BPI ENDGAME FUNCTIONAL TIMELINE

T_{int} – 30 seconds | T_{int} – m seconds | T_{int} – n seconds | T_{int}







Initial Acquisition Phase

(1) Acquire Threat Complex

(2) Designate Track Feature

Track Phase

(1) Correlate Data Frame-to_Frame

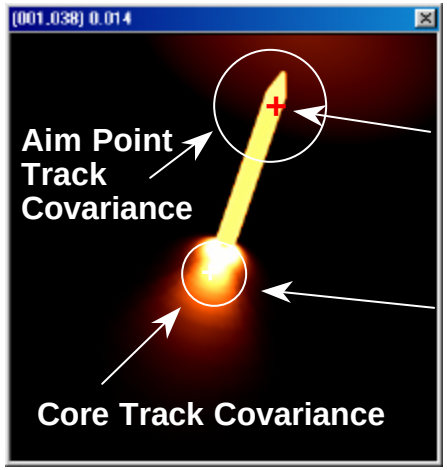
(2) Refine Track File For Guidance

(3) Search For Hardbody

Terminal Phase

(1) Isolate Hardbody From Plume

(2) Calculate Lethal Aim Point

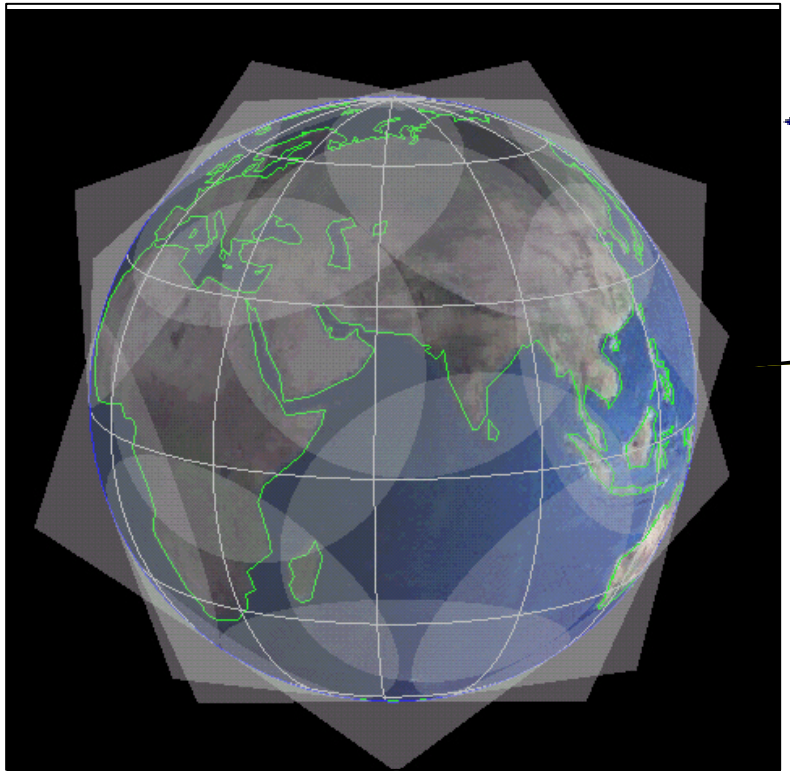


Current Aim Point Location

Current Core Location

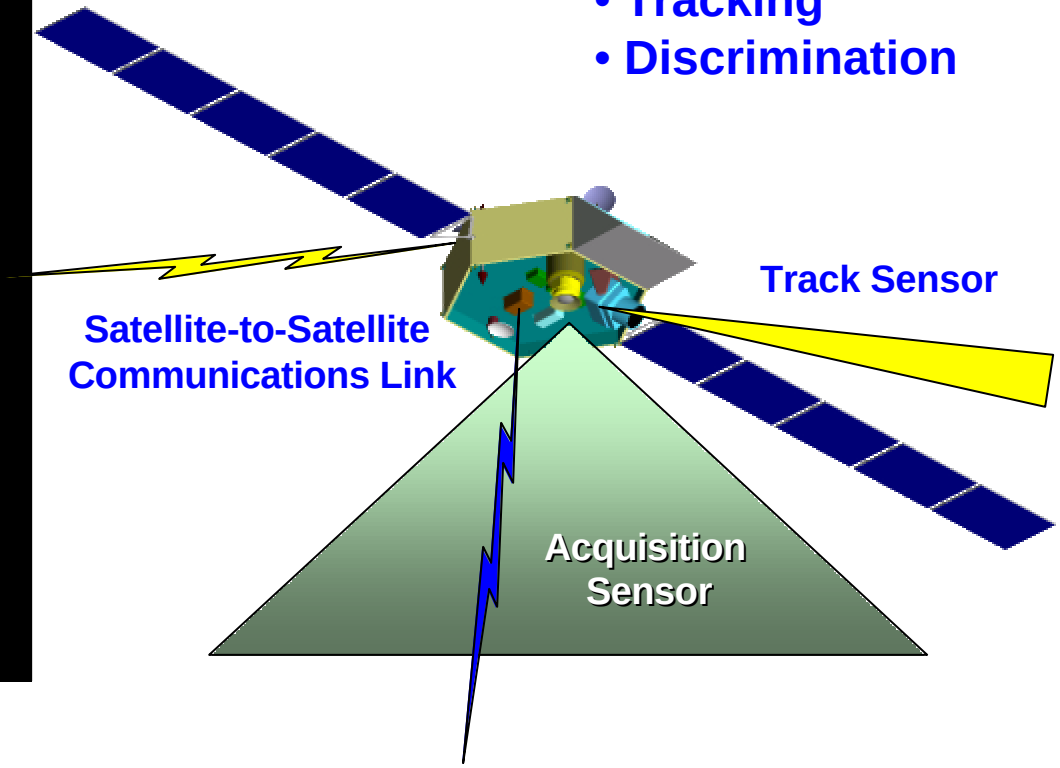
SBIRS INCREMENT 3 (Full Constellation)

SBIRS Low "Full Constellation"



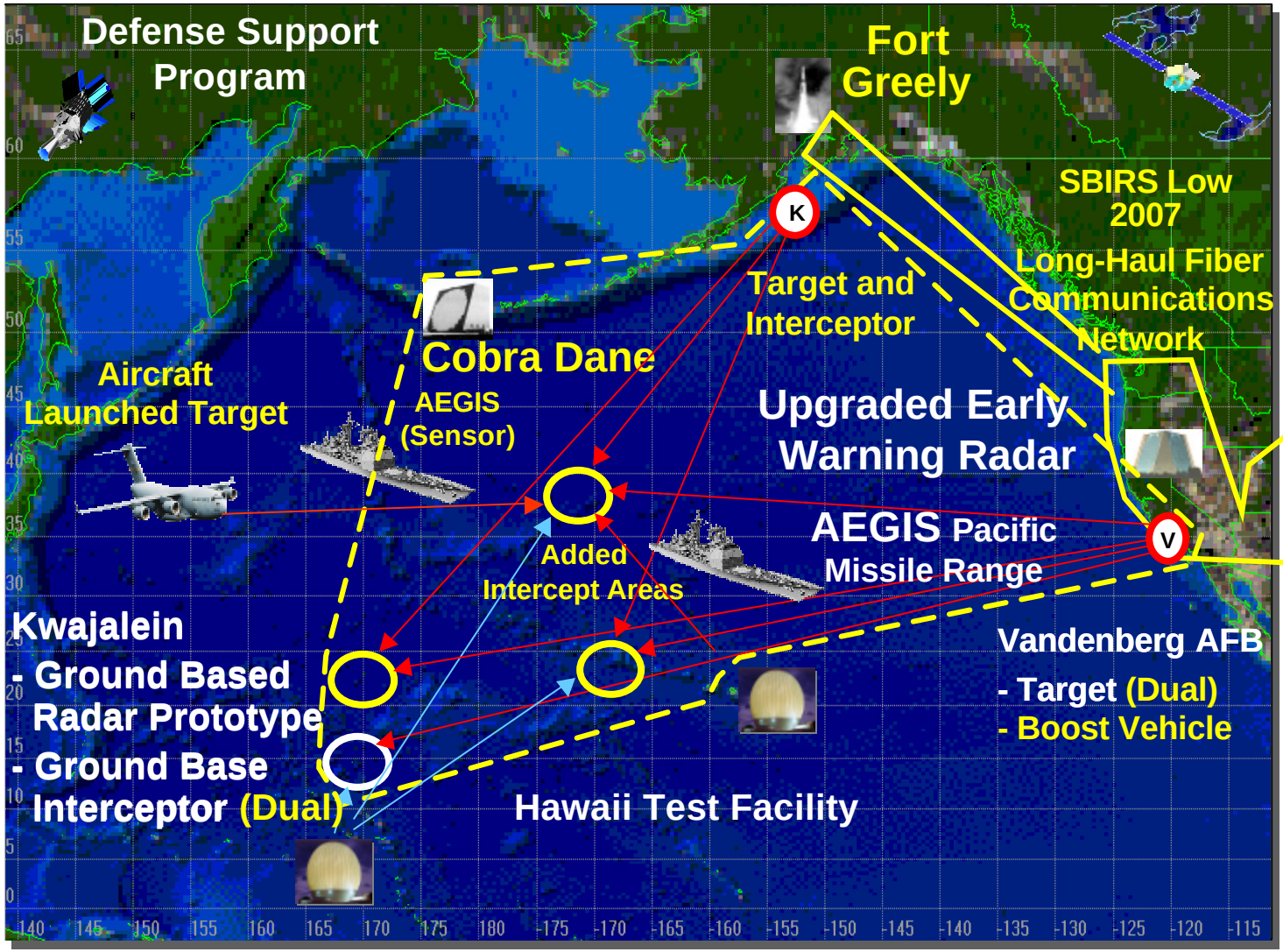
Constellation Size Is Approximately 30 Satellites

Ballistic Missile
- Detection
- Tracking
- Discrimination



Direct Communications To Theater

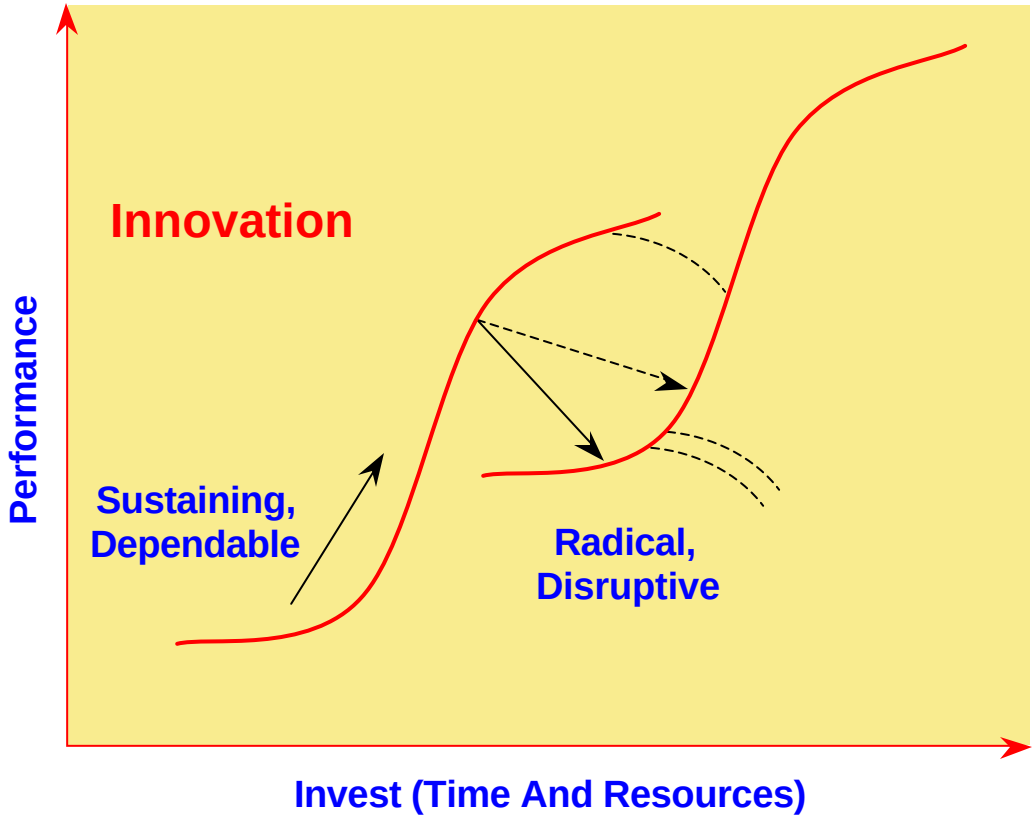
BMDS TEST BED



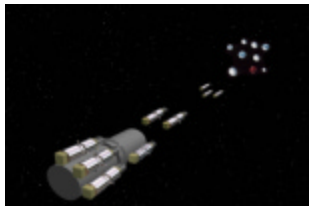
Key: Current
Enhanced
SBIRS Low Viewing

- Common Test Bed For Ground- And Sea-Based Elements
- Expandable To Boost And Terminal Segments
- Adds Realism To Test
- Allows Multiple Engagements
- Adds Additional Intercept Areas
- Enhances Ground Test Capability
- Adds SBIRS High And Low Testing

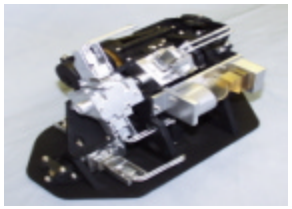
SCIENCE AND TECHNOLOGY
MDA APPROACH



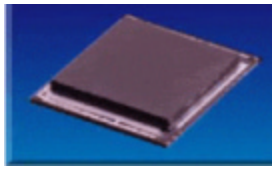
FY 02 TECHNOLOGIES



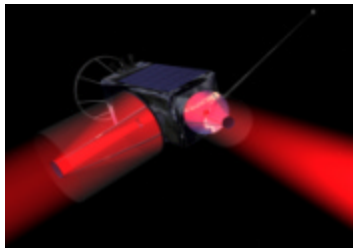
Miniature Kill Vehicle (MKV)



Discriminating Seeker



Advanced Focal Plane Array



Space Relay Mirrors

Revolutionary Concepts / Capabilities

- High-speed Atmospheric Interceptor (Terminal)
- Doppler LADAR For Interceptor Seeker To Dramatically Improve Discrimination (Midcourse)
- Interactive Discrimination (Midcourse)
- Low Cost Miniature Kill Vehicles (Midcourse)
- Novel Space Sensors (Boost)
- Airship / UAV-Based Sensors And Weapons (Boost)
- Space Relay Mirrors For RV Tracking (Global)
- Advanced Discriminating Radar (Global)

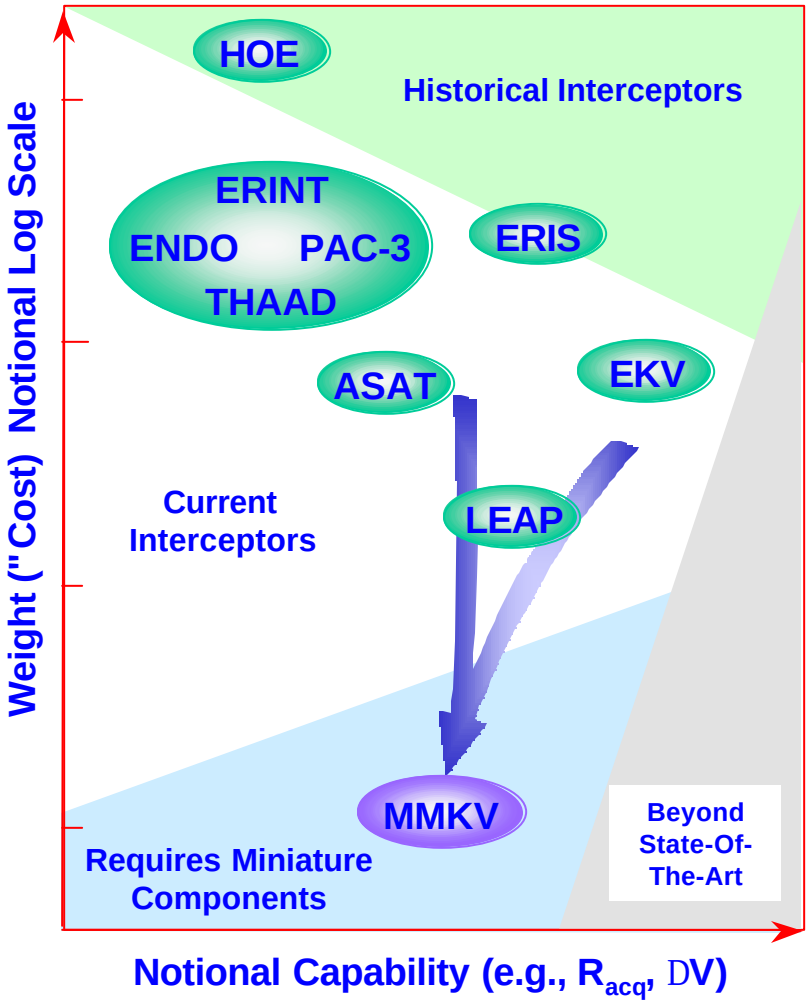
Science And Technology Investment Strategy

- Focus On High Payoff Technology At Technology Readiness Levels (TRLs) 1 Through 4
- Configure Program To Deliver Specific Products That Can Be Transitioned To Major Elements Of The Overall BMD System
- Emphasize The Development Of Enabling Technology For Revolutionary Concepts
- Leverage DoD And Service Investments In Generic Or Multi-mission Science And Technology

Challenges

- Actual Transition Of Technology Successes Into Major Projects
- Restructure Of Small Business Innovation Research (SBIR) Program To Be More Relevant To The Needs Of Ballistic Missile Defense
- Stabilization Of S&T Funding

MINIATURE KILL VEHICLE



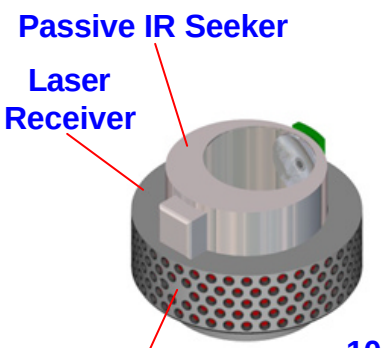
- Kill Vehicle Paradigm Shift
  - From A Sniper To A Shotgun
- Meet Size And Weight Goals
- Maintain Single Interceptor Performance
  - See Far Enough
  - Move Fast And Far Enough
  - Meet Or Beat 'Cost Per Kill'
- Balanced Technology Development
  - Evolutionary Versus Revolutionary
  - Risk Versus Reward
- Incorporate Emerging Technologies
  - Micro-Electro-Mechanical Systems (MEMS)

MINIATURE KILL VEHICLE (MKV) CONCEPT

Description

- MKVs Intercept Multiple Objects In A Single Threat Cloud
  - Submunitions, Decoys, And Jammers
- MKVs Are Housed In A Ground Launched Carrier Vehicle (CV). CV Contains Sensors To Interrogate The Threat Cloud And Vector MKVs To Individual Targets

Candidate Miniature KV

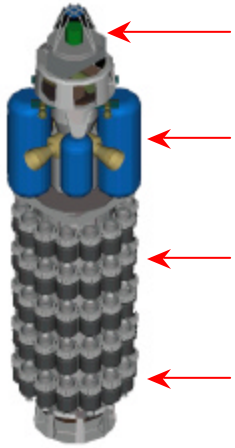


Endgame Homing Options

- Autonomous
- Laser Designation
- Semiactive

10 cm Diameter
5 cm Length
Kilogram-level Mass

Candidate Payload Configuration



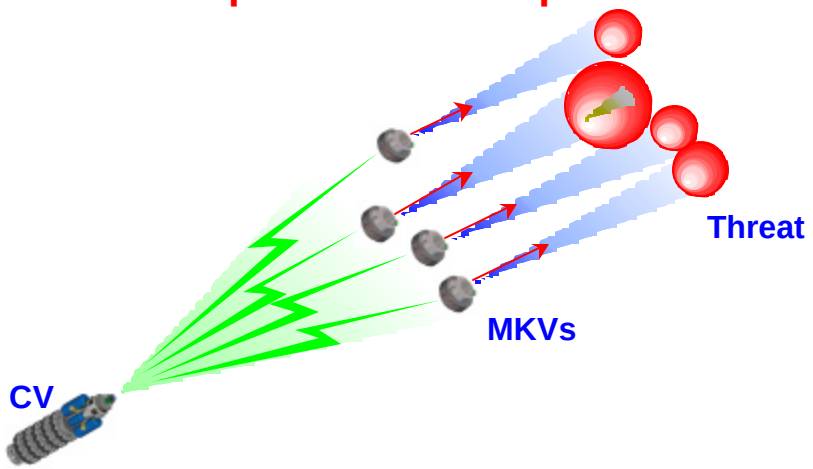
Passive / LADAR Bus Sensor

Onboard Propulsion System

MKV Section Contains And Dispenses From 20-30+ MKVs

Communications Package Provides Interface To External Elements

Operation Concept



BALLISTIC MISSILE DEFENSE PROGRAM APPROACH

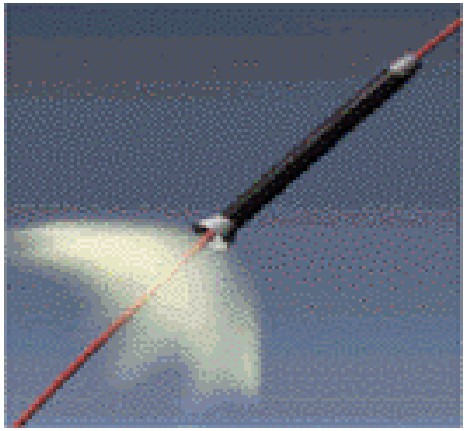
- Single BMD Research And Development Program With Goal Of Entering Into Production Or Procurement As Soon As Directed
- Started With What We Know – Build On The Technical Progress Made To Date Without Losing Focus
- Prove Capability Through Realistic Testing – Expand Test Bed
- Transition Capabilities To Services For Production, Deployment And Support
- Add Capability In Block Increments Over Time
- Aim For An Initial Capability In The 2004-2008 Time Frame
- Move To A Layered Defense Soonest
- Extend To Allies And Friends When Appropriate

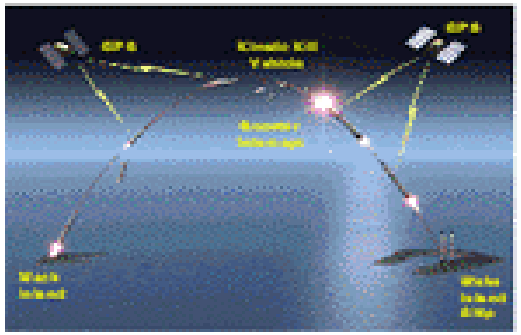
The Program Is A Bold Move To Develop An Effective, Integrated Layered Missile Defense Against All Ranges Of Threats

PULLS

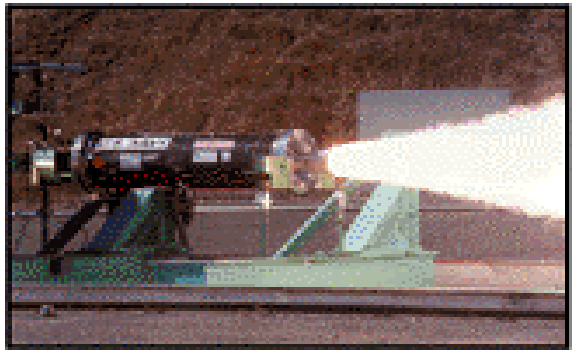
TECHNOLOGIES IDENTIFIED FOR RISK REDUCTION

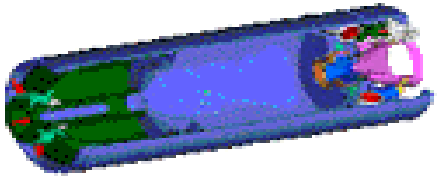
Phenomenology



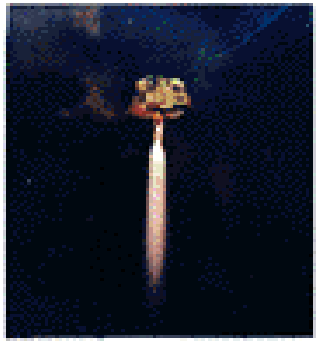


Booster

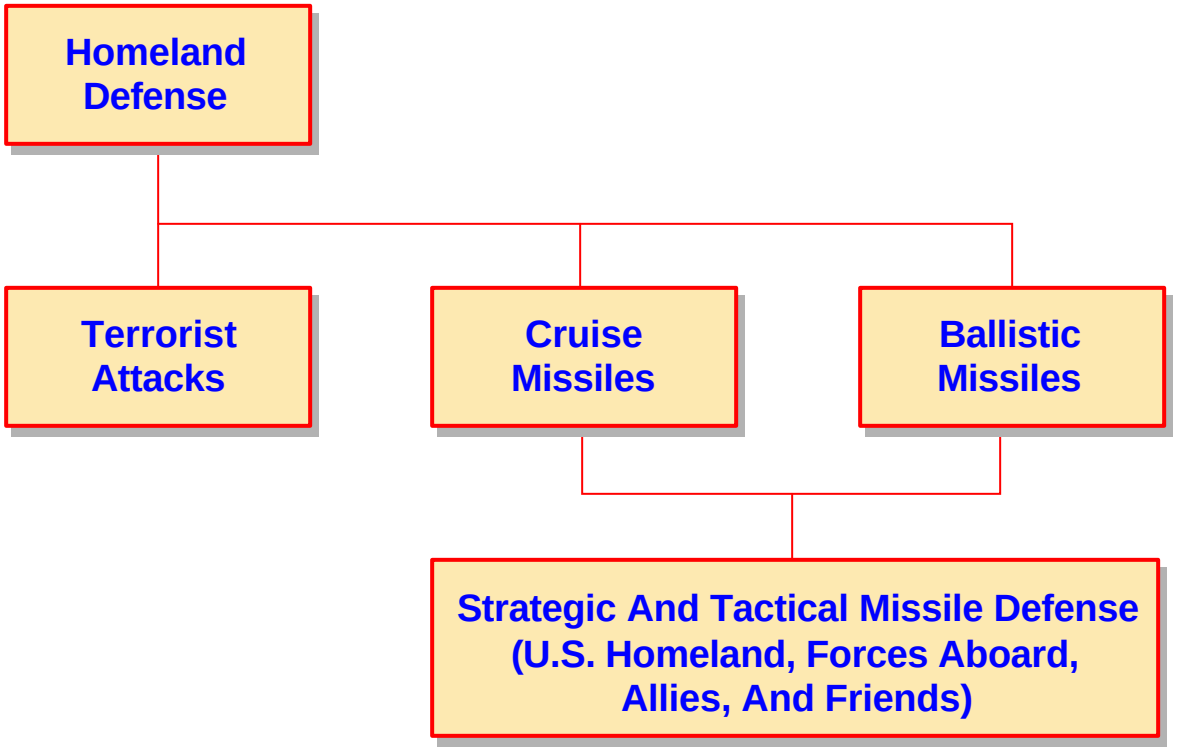




Kill Vehicle



MISSILE DEFENSE MISSION IN CONTEXT



Switching From "Threat-Based" To "Capability-Based" Planning

DoD WIDE S&T PROGRAMS THAT SUPPORT MISSILE DEFENSE

Platforms	UAVs, UCAV, Airships
Sensors	Space Sensors, Including Space Based Radar
Weapons	Directed Energy Weapon Research
Joint C4ISR	Find And ID Fixed And Mobile Missile Launchers